

REMARKS

Applicant respectfully requests reconsideration of this application, as amended, and consideration of the following remarks. Claims 17-22 have been canceled as being drawn to a non-elected invention. Claims 1-16 remain pending. Claims 1-16 stand rejected under 35 U.S.C. 112, second paragraph.

Amendments

Revisions to the Specification

Applicant has amended the specification to correct a typographical error. No new matter has been added.

Rejections

Rejections under 35 U.S.C. §112 second paragraph

Claims 1-16 stand rejected under 35 U.S.C. 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. Applicant respectfully traverses this rejection.

Applicant draws the examiners attention to the paragraphs 36-40 of the specification which provide as follows:

“[36] In an operation 110, a first portion of the etch byproducts (e.g., as CuCl_2 , CuCl , or elemental copper) can be deposited on the inner surfaces of the process chamber. In an operation 115, a remainder of the volatile etch byproducts can be output from the process chamber such as by a purge or a vacuum.

“[37] By way of example, a chlorine containing etch chemistry can etch a copper layer on the substrate, forming etch byproducts including Cu_3Cl_3 , CuCl_2 , CuCl and elemental copper. At the process temperature of about 200 degrees C or greater, Cu_3Cl_3 is volatile while CuCl_2 , CuCl and elemental copper may not be volatile. A non-volatile first portion of the etch byproducts (e.g., CuCl_2 , CuCl and elemental copper) can deposit on the inner surfaces of the process chamber even at temperatures well above 200 degrees C (e.g., greater than about 400 degrees C). A second, volatile portion of the etch byproducts (e.g., the Cu_3Cl_3) is output from the process chamber.

“[38] However, as a second portion of the Cu_3Cl_3 cools (e.g., as the Cu_3Cl_3 contacts a cooler surface such as the inner surface of the process chamber), the second portion is converted to CuCl_2 , which is not volatile at the process temperature. Therefore, while

Cu_3Cl_3 is formed during the etch process, a layer of CuCl_2 can be formed on the inner surfaces of the process chamber.

“[39] In an operation 120, the inner surfaces of the process chamber are heated to the process temperature. In an operation 125, the hydrogen input with the halogen based etch chemistry can react with the layer of etch byproducts (e.g., CuCl_2) that is formed on the inner surfaces of the process chamber. The non-volatile copper chloride is reduced to elemental copper and the chlorine combines with the hydrogen to form HCl that is volatile at the process temperature.

“[40] In an operation 130, the elemental copper can react with the halogen based plasma to become one or more volatile species that can be removed from the process chamber through the outlet in an operation 135. The method operations can then end. It should be understood that the operations 105-135 are not required to be performed in the order illustrated. Some of the operations may occur substantially simultaneously or in an order other than as described.”

Referring now to claim 1, which provides:

- “1. A method for cleaning a processing chamber comprising:
heating an inner surface of the processing chamber to a first temperature, the first temperature being sufficient to cause a first species to become volatile, the first species being one of a plurality of species deposited on the inner surface;
injecting a cleaning chemistry into the processing chamber, the cleaning chemistry being reactive with a second one of the plurality of species to convert the second species to the first species; and
outputting the volatilized first species from the processing chamber.”

The claimed method is a method for cleaning a process chamber. The process chamber needs to be cleaned because it has been used in a previous or even an ongoing process resulting in undesirable residues of etch byproducts (e.g., CuCl_2 , CuCl and elemental copper) remaining as deposits and other forms (i.e., vapor) in the process chamber.

Depending on the process being performed in the process chamber, the process chamber can have a temperature of less than about 200 degrees C such that even Cu_3Cl_3 can remain within and even as deposits on the surfaces of the process chamber. Therefore, before the cleaning process is initiated, the process chamber may or may not have a temperature of greater than about 200 degrees C.

Cleaning the process chamber includes heating an inner surface of the processing chamber to a first temperature, the first temperature being sufficient to cause a first species (e.g., Cu_3Cl_3) to become volatile, the first species (e.g., Cu_3Cl_3) being one of a plurality of species deposited on the inner surface.

As stated in paragraph 37 “temperature of about 200 degrees C or greater, Cu_3Cl_3 is volatile”, therefore if the first species is Cu_3Cl_3 then the first temperature can be equal to or greater than about 200 degrees C. If the process chamber already had a temperature sufficient to cause the first species to become volatile, then it may not be necessary to heat the process chamber, however, the cleaning process requires that the process chamber is at least maintained at if not heated to the temperature sufficient to cause the first species to become volatile.

The cleaning process can also include injecting a cleaning chemistry into the processing chamber, the cleaning chemistry being reactive with a second one (e.g., elemental copper) of the plurality of species to convert the second species (e.g., elemental copper) to the first species (e.g., Cu_3Cl_3).

As stated in paragraph 40: “the elemental copper can react with the halogen based plasma to become one or more volatile species”. More specifically, paragraph 37 states a halogen containing etch chemistry such as a “chlorine containing etch chemistry can etch a copper layer ... forming etch byproducts including Cu_3Cl_3 ...”

The cleaning process can also include outputting the volatilized first species (e.g., Cu_3Cl_3 including the converted second species (e.g., elemental copper)) from the processing chamber.

Accordingly, Applicant respectfully submits that Applicant’s invention as claimed in claims 1-16 are not indefinite, and respectfully request the withdrawal of the rejection under 35 U.S.C. §112, second paragraph.

SUMMARY

In view of the foregoing amendments and remarks, Applicant respectfully submits that the pending claims are in condition for allowance. Applicant respectfully requests reconsideration of the application and allowance of the pending claims.

If the Examiner determines the prompt allowance of these claims could be facilitated by a telephone conference, the Examiner is invited to contact George B. Leavell at (408) 749-6900, ext 6923.

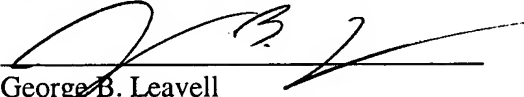
Deposit Account Authorization

Authorization is hereby given to charge our Deposit Account No. 50-0805 (Ref LAM2P460) for any charges that may be due or credit our account for any overpayment. Furthermore, if an extension is required, then Applicant hereby requests such extension.

Respectfully submitted,

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